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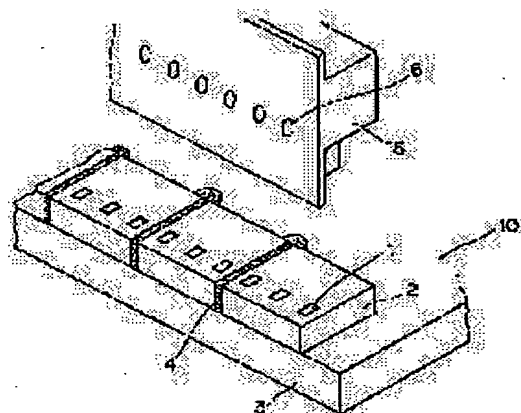
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(54) INK JET RECORDING HEAD, AND MANUFACTURE THEREOF

(57)Abstract:

PURPOSE: To in expansively and easily carry out the mass-production by a method wherein a plurality of short sub-units, each of which is equipped with energy-generating elements for ejecting ink, are arranged on a base plate, and gaps between the sub-units are filled with fluid hardening materials.

CONSTITUTION: A plurality of sub-units (silicon base plate units) 2, on which energy-generating elements 1 are patterned are arranged on a base plate 3, and are respectively fixed to the base plate 3 with screen-printed thermosetting adhesive in the thickness of several μm . After the adhesive is cured, silicone sealant is dropped to the rear part on each of the gaps between the base plate units 2, and the gaps are filled with the sealant by capillary action. After the base plate units 2 and PCB boards already stuck to the base plate 3, are connected together by wire bonding, a top plate 5 having ink ejecting ports 6 is joined, and an ink jet recording head is completed.



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CLAIMS

[Claim(s)]

[Claim 1] The 1st substrate in which the regurgitation energy generation component used in order to carry out the regurgitation of the ink was formed, The 2nd substrate which has a crevice for forming the ink passage corresponding to the arrangement part of said regurgitation energy generation component by joining to this substrate, In the ink jet recording head equipped with the delivery formation member in which the delivery for it being open for free passage to said ink passage, and carrying out the regurgitation of the ink was formed Two or more subunits which are the short length substrates with which said 1st substrate formed the regurgitation energy generation component used in order to carry out the regurgitation of the ink are arranged on a base plate. And the crevice between said subunits is an ink jet recording head characterized by being buried by fluid hard spot material and formed.

[Claim 2] The ink jet recording head according to claim 1 characterized by forming the slot in the part corresponding to the crevice between said subunits on the base plate holding said 1st substrate.

[Claim 3] The ink jet recording head according to claim 1 or 2 characterized by joining said 1st substrate and said 2nd substrate so that the heights of the crevice of said 2nd substrate and the crevice between the subunits fill uped with said fluid hard spot material may correspond.

[Claim 4] The ink jet recording head according to claim 1 to 3 to which said fluid hard spot material is characterized by being room-temperature-setting nature resin.

[Claim 5] The 1st substrate in which the regurgitation energy generation component used in order to carry out the regurgitation of the ink was formed, The 2nd substrate which has a crevice for forming the ink passage corresponding to the arrangement part of said regurgitation energy generation component by joining to this substrate, In the manufacture approach of the ink jet recording head equipped with the delivery formation member in which the delivery for it being open for free passage with said ink passage, and carrying out the regurgitation of the ink was formed Two or more subunits which are the short length substrates in which the regurgitation energy generation component used in the 1st substrate in order to carry out the regurgitation of the ink was formed are arranged on a base plate, and the crevice between subunits is fill uped with fluid hard spot material, and is formed, The manufacture approach of the ink jet recording head by which it is characterized.

[Claim 6] The manufacture approach of the ink jet recording head according to claim 5 characterized by forming a slot in the part corresponding to the crevice between said subunits on the base plate holding said 1st substrate.

[Claim 7] The manufacture approach of the ink jet recording head according to claim 5 or 6 characterized by joining said 1st substrate and said 2nd substrate so that the heights of said crevice of said 2nd substrate and the crevice between the subunits fill uped with said fluid hard spot material may correspond, in case said 2nd substrate is joined to said 1st substrate.

[Claim 8] The manufacture approach of an ink jet recording head according to claim 5 to 7 that said fluid hard spot material is characterized by being room-temperature-setting nature resin.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to an ink jet recording head especially a long ink jet recording head, and its manufacture approach.

[0002]

[Description of the Prior Art] Conventionally, many approaches are shown as mass production technology of an ink jet recording head (JP,55-90375,A, JP,56-72967,A, JP,60-196345,A, JP,61-154947,A). Fundamentally, patterning of the regurgitation energy generation component is carried out, the member which, subsequently to this substrate top, forms ink passage, a liquid room, and a delivery is prepared on a substrate, and it considers as an ink jet recording head. These techniques are suitable for making a small ink jet recording head like the ink jet recording head of a serial printer.

[0003] There is the approach of carrying out the array of many ink jet recording heads (unit) of (1) (2) short length to the approach of applying said approach to a long substrate as a technique which mass-produces the long ink jet recording head used for a line printer, and using as one long ink jet recording head.

[0004] When the approach of (1) is absolutely perfect and it is going to carry out patterning of the regurgitation energy generation component corresponding to about 3000 bits at 360dpi used as the current mainstream on a substrate, it has the fault that the yield worsens dramatically.

[0005] About the approach of (2), the approach (JP,55-132253,A) of arranging a unit alternately, and the approach (JP,2-2009,A, JP,3-167957,A, JP,4-229278,A) of attaching and hitting the end face of a unit and arranging to a single tier are proposed. These approaches are dramatically useful as that with which the fault of the technique of the approach of the above (1) is compensated. It is because the yield will improve rather than the approach of the above (1) if it sorts out and finishes setting up only the excellent article of a short length unit.

[0006] The method of arranging a unit alternately is an approach that feasibility is the highest, and has some which have come out to the commercial scene as goods. However, the ink supply system to each unit becomes complicated, or there is a fault of ink supply to a unit stopping fulfilling demand at the time of high-speed printing etc.

[0007] The approach of attaching and hitting the end face of a unit and on the other hand, arranging to a single tier is technically difficult. As patent reference, although some are exhibited, what is produced commercially is not seen in a commercial scene. It is mentioned that it is difficult to arrange at spacing as

which a unit sticks, and commercialization is the reliance section as a difficult reason, and was able to determine the nozzle.

[0008] The important section in the case of attaching and hitting the end face of a unit to drawing 11, and arranging to a single tier is shown. In this drawing, ink passage attaches the substrate with which a unit and 12 carry out the energy generation component for the ink regurgitation, and, as for 13, 11 has carried out patterning of the energy generation component 12, and 14, a unit attaches 15, and a reliance side and 16 stick, stick with a reliance side, and are a septum between the passage nearest to a reliance side. The dimension in the case of carrying out the array of the ink jet recording head whose passage cross-section dimension of 360dpi is 0.0505x0.0505mm (unit mm) is also entered in this drawing. A unit sticks and the thickness of the septum between the reliance side 15 and the passage of an endmost part is only 0.010mm so that clearly from this drawing. It is almost impossible to leave such a very thin part and to form a unit current. Furthermore, when attaching and hitting the end face of a unit and arranging to a single tier, in order for a contaminant to keep as close or to raise between units the precision of about [that there is a possibility that a pitch may be out of order with thermal expansion etc.], and a unit end face, cost starts dramatically. Then, solving the above-mentioned problem was proposed by opening a crevice between units (JP,4-229278,A).

[0009] However, by opening ** crevice, ink leakage comes to be easy from the lower part of the liquid flow channel corresponding to unit both ends, and the liquid flow channel of the unit edge where the ink enters a crevice and adjoins in the case of the regurgitation raises a cross talk.

[0010] ** When ink invades from crevices, such as a protective coat produced by cutting etc. at the unit edge, cause an electric corrosion.

[0011] Which problem occurred.

[0012]

[Problem(s) to be Solved by the Invention] As mentioned above, patterning of the regurgitation energy generation component is carried out to the substrate of the long picture of the die length equivalent to page width without a defect, the member which forms ink passage and a liquid room on this is prepared, and it does not balance in cost by the approach of forming an ink jet recording head.

[0013] On the other hand, an ink supply system becomes complicated or the approach of carrying out the array of the short length ink jet recording head (unit) alternately has the fault of supply of the ink to a unit stopping fulfilling demand at the time of high-speed printing etc. Furthermore, since an ink supply system becomes complicated, it is mentioned as a fault that the miniaturization of a head is also difficult.

[0014] Moreover, it is expected that it will become expensive since the yield is bad even if the approach of attaching and hitting the end face of a unit and arranging to a single tier is technically difficult and it can do it.

[0015] This invention conquers the fault of these conventional techniques, and aims at offering the technique which can mass-produce cheaply and easily the long ink jet recording head used for a line printer etc.

[0016]

[Means for Solving the Problem] The 1st substrate in which the ink regurgitation energy generation component used in order that this invention may carry out the regurgitation of the ink was formed, The 2nd substrate which has a crevice for forming the ink passage corresponding to the arrangement part of said regurgitation energy generation component by joining to this substrate, In the ink jet recording head

equipped with the delivery formation member in which the delivery for it being open for free passage with said ink passage, and carrying out the regurgitation of the ink was formed the 1st substrate of ** above Two or more subunits which are the short length substrates in which the regurgitation energy generation component used in order to carry out the regurgitation of the ink was formed are arranged on a base plate, and the crevice between said subunits is filled up with fluid hard spot material, and it is formed, ** In an ink jet recording head that the slot is formed in the part corresponding to the crevice between subunits on the base plate holding the 1st substrate in the ink jet recording head of the aforementioned **, the ** aforementioned **, or given in ** So that the heights of the crevice of the 2nd substrate and the crevice between the subunits filled up with fluid hard spot material may correspond In an ink jet recording head that the 1st substrate and the 2nd substrate are joined and the ** aforementioned **, **, or given in **, it is characterized by fluid hard spot material being room-temperature-setting nature resin.

[0017] The 1st substrate which furthermore formed the regurgitation energy generation component used in order that this invention may carry out the regurgitation of the ink, The 2nd substrate which has a crevice for forming the ink passage corresponding to the arrangement part of said regurgitation energy generation component by joining to this substrate, In the manufacture approach of the ink jet recording head equipped with the delivery formation member in which the delivery for it being open for free passage with said ink passage, and carrying out the regurgitation of the ink was formed ** Arrange two or more subunits which are the short length substrates in which the regurgitation energy generation component used in the 1st substrate in order to carry out the regurgitation of the ink was formed on a base plate, and the crevice between subunits is filled up with fluid hard spot material, and form it, ** Form a slot in the part corresponding to the crevice between said subunits on the base plate which holds said 1st substrate in the manufacture approach of the ink jet recording head of the aforementioned **, In case it joins to said 1st substrate at said 2nd substrate in the manufacture approach of the ink jet recording head of the aforementioned ** or **, ** With the heights of said crevice of said 2nd substrate So that the crevice between the subunits filled up with said fluid hard spot material may correspond In the manufacture approach of the ink jet recording head of joining said 1st substrate and said 2nd substrate and the ** aforementioned **, **, or **, said fluid hard spot material is the manufacture approach of the ink jet recording head characterized by being room-temperature-setting nature resin.

[0018] Which a well-known thing is sufficient as the ink regurgitation energy generation component used by this invention, for example, an exoergic resistor is mentioned.

[0019] The ingredient of the 1st substrate is a well-known insulator, and what is easy to carry out patterning of the energy generation component, for example, a silicon wafer, is desirable.

[0020] Although especially the base plate that lays a subunit does not ask the class of ingredient, a metal plate, for example, the plate made from stainless steel, and an aluminum plate are used preferably.

[0021] As fluid hard spot material which fills the crevice between subunits, room-temperature-setting nature resin, especially silicone system encapsulant are desirable.

[0022] Hereafter, this invention is explained using a drawing.

[0023] Drawing 1 is the explanatory view showing the description of the ink jet recording head of this invention. In this drawing, the subunit (silicon substrate unit) to which 1 carried out the ink regurgitation energy generation component, and 2 carried out patterning of the energy generation component 1, the base plate with which 3 arranged the subunit 2, and 4 are fluid hardenability resin which filled between the subunits arranged on the base plate 3, and these are the elements of the 1st

substrate. The top plate which fabricated and obtained to one the 2nd substrate which has the crevice which forms passage, and the delivery formation member (orifice plate) which forms a delivery (orifice), and 6 are the deliveries (orifice) formed in the top plate 5 by joining 5 corresponding to the energy generation component 1.

[0024] Drawing 2 is the explanatory view showing the description of the ink jet recording head of this invention of other examples. In this drawing, the part of drawing 1 and this notation expresses the same part. In this instantiation, in order to control the flow nature of silicone system room-temperature-setting nature resin which fills between subunits, it is just going to differ from drawing 1 that there is a guide slot 7 formed on the base plate 3. The cross-section configuration of a guide slot has desirable square mold of V characters etc.

[0025] The ** type-perspective view showing the configuration of the ink jet recording head (IJH) using the 1st substrate and top plate 400 into which drawing 3 processed this invention, and drawing 4 are drawings for explaining the configuration of components with the main ink jet recording head which applied this invention. This example explains the ink jet recording head of the 3008 delivery number (print width of 212mm) of the consistency 360dpi (70.5 micrometers) ink of an ink delivery.

[0026] In drawing 4 , as for the heater board (subunit) 100, 128 regurgitation energy generation components 101 are formed in a position by the consistency of 360dpi. 102, such as a power pad for supplying the power for the signal pad which makes the regurgitation energy generation component 101 drive to the timing of arbitration with the electrical signal from the outside, and its actuation etc., is prepared in this.

[0027] Adhesion immobilization of the heater board 100 is carried out with adhesives on the front face of the base plate 300 made from stainless steel.

[0028] The detail drawing in the condition of having arranged the heater board 100 in drawing 5 is shown. Adhesion immobilization is carried out by the adhesives 301 applied to the predetermined location of a base plate 300 by predetermined thickness, and in this case, the heater board 100 is arranged with a sufficient precision so that the pitch of the regurgitation energy generation component of the heater board which adjoins the pitch as the pitch of $P = 70.5$ micrometers arranged on the heater board 100 with the same regurgitation energy generation component 101 prepared on the heater board 100 may become. Moreover, the clearance between heater board comrades produced in this invention in this case is closed with encapsulant 302.

[0029] It returns to drawing 4 and adhesion pasting of the wiring substrate 200 is carried out like the heater board 100 at the base plate 300. Under the present circumstances, adhesion pasting is to be carried out by physical relationship from which the pad 102 on the heater board 100, and the signal and electric power supply pad 202 which were prepared on the wiring substrate 200 serve as position relation. Moreover, the connector 201 for supplying the printing signal and actuation power from the outside is formed in the wiring substrate 200.

[0030] Next, a top plate 400 is explained.

[0031] After carrying out cutting of an orifice-plate front face, and an ink passage forming face and a heater board plane of composition simultaneously after shaping by the approach mentioned above, a top plate 400 forms a ** ink nature coat in an orifice-plate front face so that the orifice periphery section on the front face of an orifice plate may get wet in ink and may not reduce discharging performance.

[0032] Then, **** lump formation of the ink passage slot corresponding to each regurgitation energy

generation component 101 of the heater board 100 is carried out with an excimer laser. Under the present circumstances, laser beams are 128 passage units as well as the unit of a heater board, and a mask is used for them and they repeat processing. Subsequently, piercing of the orifice is carried out in 128 units using a mask like [side / of the end of each ink passage slot after ink passage recessing / orifice-plate rear-face] an ink passage slot.

[0033] By drawing 6 , a top plate 400 It corresponds to the regurgitation energy generation component 101 prepared in the heater board 100. In order to supply ink to the orifice 413 and each passage 412 which were open for free passage to each passage for being prepared corresponding to the passage 412 and each passage which were prepared, and making a record medium turn and breathe out ink It has components, such as the ink feed hopper 414 for making the ink supplied from the ink tank (not shown) to the liquid room 411 and the liquid room 411 which were open for free passage to each passage flow. The top plate 400 consists of die length which covers mostly the regurgitation energy generation element array which could be located in a line in the heater board 100 with the natural thing, and was prepared, and hangs. [two or more]

[0034] It returns to drawing 4 , and it unites and a top plate 400 combines physical relationship with the regurgitation energy generation component on the heater board 100 arranged in on the passage 412 and base plate 300 so that it may become position relation.

[0035] Under the present circumstances, there are various approaches, such as holding down in mechanism with the spring electrode holder 510 which holds a spring 500 and a spring 500 as shown in drawing 3 as the approach of association, fixing with adhesives, or combining them. A top plate 400 and the heater board 100 are fixed by relation as shown in drawing 7 by these.

[0036] Although what is necessary is just resin which can form a slot in accuracy as an ingredient which constitutes a top plate 400, it is desirable to excel in a mechanical strength, dimensional stability, and ink-proof nature further. As such an ingredient, an epoxy resin, acrylic resin, diethylene glycol, dialkyl carbonate resin, an unsaturated polyester resin, polyurethane resin, polyimide resin, melamine resin, phenol resin, a urea resin, etc. are desirable, and resin, such as Pori Sall John and a polyether ape phone, is especially desirable from viewpoints, such as the moldability and acidity or alkalinity-proof.

[0037] This top plate 400 is resin and that coefficient of thermal expansion is 1×10^{-5} to about four [1×10^{-5} to]. Pori Sall John (coefficient of thermal expansion 56×10^{-6}) explains below. When silicon is used for the heater board 100, the coefficient of thermal expansion of the stainless steel which used the coefficient of thermal expansion for the base plate 300 which arranged 2.4×10^{-6} and the heater board 100 is 17.3×10^{-6} . Even if it assembles a head with a sufficient precision with the configuration of this as in the temperature neighborhood of 25 degrees C, temperature rises at the time of that actuation, and the head may have become [enough] about 60 degrees C. With the configuration of this as The number of nozzles Pitch Temperature gradient Coefficient-of-thermal-expansion difference $3008 \times 0.0705 \times (60-25)$ A gap of $x(56 \times 10^{-6} - 17.3 \times 10^{-6}) = 0.287 \text{mm}$ arises. This is a value for four nozzles and cannot be used at all. Then, the supporter material 415 which regulates the thermal expansion coefficient of a top plate 400 as shown in a top plate 400 in xx cross section of drawing 6 (B) is put in into the resin of a top plate 400. The supporter material 415 is made of the same stainless steel as a base plate 300 here. In addition, blasting and surface treatment like knurling tool processing are carried out to the front face, and the degree of adhesion of supporter material 415 with the resin of a top plate 400 improves, and it learns the coefficient of thermal expansion of a top plate 400 from it of stainless steel from the mechanical strength. Since the

top plate 400 and base plate 300 of a head have the same coefficient of thermal expansion by carrying out like this, a gap like previous count is not produced at all.

[0038] However, it will be set to $128 \times 0.0705 \times (60-25) \times (17.3 \times 10^{-6} - 2.4 \times 10^{-6}) \times 0.005 \text{ mm}$ if it carries out from the same count as a front by the reason for producing differential thermal expansion between the heater boards 100 of 128 bitwises. It turns out that gaps are $0.005 / 2 = 0.0025$, i.e., 2.5micro, and, as for this, the nozzle of both the sides of a heater board and a gap of a heater produce no trouble in the discharging performance.

[0039] Next, the recording head of this invention is explained with reference to drawing 8 and drawing 9. As explained until now, by joining the top plate with which the orifice, the liquid flow channel, etc. were made at the base-plates top, such as glass, silicon, ceramics, and a metal, to what two or more precision improved [arrangement adhesion] the heater board on which the regurgitation energy generation component was made, passage is formed and an ink jet recording head is manufactured. Drawing 8 shows typically the ink jet cartridge (IJC) which applied such an ink jet recording head. The ink tank 901 which can store the ink for supplying this IJC to the ink jet recording head 900 and its ink jet recording head is formed in one.

[0040] Drawing 9 shows the so-called full line type which has the width of face corresponding to the recording width of a record medium in which the most remarkable effectiveness appears among the recording heads which can apply this invention of ink jet recording head, and typical approximate account drawing of the ink jet recording device.

[0041] In drawing 9, 600 shows the full line ink jet recording head, ink is breathed out from this ink jet recording head towards the record media 800 conveyed by the record-medium conveyance roller 700, such as paper and cloth, and record is made by this. Since a recording head is manufactured by putting in order two or more subunits which prepared the regurgitation energy generation component in the case of the ink jet recording head of this invention, it can manufacture easily also by long ink jet recording head like a full line head.

[0042] Drawing 10 shows the recording device which carried the small recording head. It has the carriage shaft 1004 grade for telling the motor 1003 as a driving source which drives the conveyance roller for the ink jet record head cartlidge with removable ink tank section 1001 and recording head section 1002 being carried on Carriage HC in the recording apparatus shown by drawing 10, and conveying this carriage and a record medium 800 etc., and the power from a driving source to carriage. Furthermore, it has the signal supply means for supplying the signal for carrying out the regurgitation of the ink to an ink jet recording head.

[0043] Although explanation which uses only one sort of monochromatic ink about the class thru/or the number of an ink jet recording head carried with the recording apparatus in explanation as stated above was given, two or more IJC(s) can be prepared corresponding to two or more ink which differs in a record color or concentration. That is, naturally the head of this invention is used also to the color recording device in which two or more heads corresponding to the ink of two or more colors were carried. Furthermore, in addition, in the example of application of this invention explained above, although ink is explained as a liquid It is ink solidified less than [a room temperature or it], and what is liquefied [which liquefies and room-temperature-softens] may be used. Or by the ink jet method, since what carries out temperature control is common as a temperature control is performed for ink itself within the limits of 30 degrees C or more 70 degrees C or less and it is in the stability regurgitation range about the

viscosity of ink, ink may use what makes the shape of liquid at the time of activity record signal grant. In addition, it may solidify in the state of neglect, and the ink liquefied with heating may be used.

[0044]

[Example] In order to explain this invention to a detail further, the example of manufacture of the ink jet recording head shown in drawing 1 and drawing 2 is described as examples 1 and 2 below, respectively.

In example 1 this example, in order to obtain the 360dpi ink jet recording head for line printers of A4 size, the subunit (silicon substrate unit) which carried out patterning of 360dpi and the 128-bit energy generation component 1 was arranged on [24] the base plate 3 made from aluminum, as shown in drawing 1.

[0045] On the occasion of the array, it arranged using the image processing so that spacing between the energy generation components in the joint of a silicon substrate unit might become the same as the pitch between the energy generation components of a silicon substrate unit. Moreover, although the crevice between the arranged silicon substrate units was designed so that it might be set to 16 micrometers, it was actually set to 2-15 micrometers from array precision and the cutting precision of a silicon substrate unit.

[0046] Moreover, just before arranging a silicon substrate unit to a base plate 3, the heat-curing mold DAIBON glue line with a thickness of several micrometers was prepared by screen-stencil on the base plate 3. Moreover, in order to arrange height with **1 micrometer, what it developed and was started from the silicon wafer was used for the arranged silicon substrate unit.

[0047] After stiffening a DAIBON glue line, the crevice between the arranged silicon substrate units trickled 0.3g (TSE399 and Toshiba Silicone, Inc.) of silicone system encapsulants behind the crevice between silicon substrate units, buried them by capillarity, and obtained the 1st substrate of the invention in this application.

[0048] Next, after connecting a silicon substrate unit and the PCB board already stuck on the base plate 3 by wire bonding, the top plate 5 which has the crevice which forms passage by joining corresponding to said energy generation component, and has the delivery of ink was joined, and the ink jet recording head was completed through mounting processes, such as closure and junction on an ink tank. When actually printed using the obtained ink jet recording head, the omission was not generated at all but printing of beautiful grace was obtained. Moreover, although we were anxious also about the regurgitation power leak (cross talk) of ink which carries out the regurgitation from the nozzle of the both sides of the crevice between silicon substrate units, the real activity top was level which is satisfactory in any way.

The silicon substrate unit was arranged on the base plate 3 by the same specification as an example 1 except having formed the guide slot 7 shown in drawing 2 on example 2 base plate 3, so that a cross-section configuration might serve as a square (0.5x0.5mm).

[0049] When there was this guide slot, the silicone system encapsulant (TSE399 and Toshiba Silicone, Inc.) used for closure of the crevice between silicon substrate units filled the crevice between silicon substrate units at first, and filled the guide slot later than it.

[0050] Before silicone system room-temperature-setting nature resin, by the way, fills the crevice between silicon substrate units by the approach which does not form the guide slot shown in the example 1 therefore, silicone system room-temperature-setting nature resin may harden, but before the crevice between silicon substrate units was fill uped with the approach of an example 2, there was that no encapsulant hardens, even if it ***** (ed) 120 times. It is thought that this is because the encapsulant

in a guide slot is probably continuously supplied to the crevice between silicon substrate units.

[0051] Anyway, the effectiveness of a guide slot was greatest, a printing grace top does not have any problem, either and the ink jet recording head of the line printer of A4 width was obtained.

[0052] Although a top plate may be made to correspond to a subunit and more than one may be prepared, you may make it join two or more subunits with one top plate in this example. In this case, since an addressing part with a passage wall becomes smooth with encapsulant when there is a level difference in the next part between subunits, it has the effectiveness that a junction condition becomes good especially.

[0053] Furthermore, although the well-known ingredient used in the field of the semi-conductor or the ink jet from the former is applicable as encapsulant, the ingredient which was excellent in electric insulation and resiliency and was excellent in ink-proof nature is more desirable. such an ingredient -- carrying out -- silicone system encapsulant and urethane system encapsulant can be raised.

[0054] Moreover, when the crevice between subunits is very narrow, it is good also considering the adhesives which fix a subunit, and the encapsulant between subunits as the same ingredient.

[0055] Especially, this invention forms a flight-drop also in an ink jet recording method using heat energy, and brings about the effectiveness which was excellent in the recording head of the ink jet method which records, and the recording device.

[0056] About the typical configuration and typical principle, what is performed using the fundamental principle currently indicated by the U.S. Pat. No. 4723129 description and the 4740796 description, for example is desirable. Although this method is applicable to both the so-called mold on demand and a continuous system On the electric thermal-conversion object which is especially arranged corresponding to the sheet and liquid route where the liquid (ink) is held in the case of the mold on demand By impressing at least one driving signal which gives the rapid temperature rise which supports recording information and exceeds nucleate boiling Since make an electric thermal-conversion object generate heat energy, the heat operating surface of a recording head is made to produce film boiling and the air bubbles in the liquid (ink) corresponding to this driving signal can be formed by one to one as a result, it is effective. A liquid (ink) is made to breathe out through opening for regurgitation by growth of these air bubbles, and contraction, and at least one drop is formed. If this driving signal is made into a pulse configuration, since growth contraction of air bubbles will be performed appropriately instancy, the regurgitation of a liquid (ink) excellent in especially responsibility can be attained, and it is more desirable.

[0057] As a driving signal of this pulse configuration, what is indicated by the U.S. Pat. No. 4463359 description and the 4345262 description is suitable. In addition, if the conditions indicated by the U.S. Pat. No. 4313124 description of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, further excellent record can be performed.

[0058] The configuration using the U.S. Pat. No. 4558333 description and U.S. Pat. No. 4459600 description which indicate the configuration arranged to the field to which the heat operation section other than the combination configuration (a straight-line-like liquid flow channel or right-angle liquid flow channel) of a delivery which is indicated by each above-mentioned description, a liquid route, and an electric thermal-conversion object is crooked as a configuration of a recording head is also included in this invention.

[0059] In addition, this invention is effective also as a configuration based on JP,59-138461,A which indicates the configuration whose puncturing which absorbs the pressure wave of JP,59-123670,A which

indicates the configuration which uses a common slit as the discharge part of an electric thermal-conversion object to two or more electric thermal-conversion objects, or heat energy is made to correspond to a discharge part.

[0060] Furthermore, although any of the configuration which fills the die length with the combination of two or more recording heads which are indicated by the description mentioned above as a recording head of the full line type which has the die length corresponding to the width of face of the maximum record medium which can record a recording device, and the configuration as one recording head formed in one are sufficient, this invention can demonstrate the effectiveness mentioned above much more effectively.

[0061] In addition, this invention is effective also when the recording head of the exchangeable chip type with which the electric connection with the body of equipment and supply of the ink from the body of equipment are attained, or the recording head of the cartridge type with which the ink tank was formed in the recording head itself in one is used by the body of equipment being equipped.

[0062] Moreover, since the effectiveness of this invention can be stabilized further, it is desirable to add the recovery means against a recording head established as a configuration of the recording device of this invention, a preliminary auxiliary means, etc. If these are mentioned concretely, it is effective in order to perform record stabilized by performing the preheating means by the capping means, the cleaning means, the application of pressure or the attraction means, the electric thermal-conversion object, the heating elements different from this, or such combination over a recording head, and reserve regurgitation mode in which the regurgitation different from record is performed.

[0063] Furthermore, as a recording mode of a recording device, not only a recording mode but a recording head is constituted only for mainstream colors, such as black, in one, or although it is good even by combination in plurality, this invention is very effective also in equipment equipped with full color at least one by the double color color of a different color, or color mixture.

[0064] In this invention example explained above, although ink is explained as a liquid The thing which is ink solidified less than [a room temperature or it], and is softened at a room temperature, or the thing which is a liquid, Or by the above-mentioned ink jet method, since what carries out temperature control is common as a temperature control is performed for ink itself within the limits of 30 degrees C or more 70 degrees C or less and it is in the stability regurgitation range about the viscosity of ink, ink should just make the shape of liquid at the time of activity record signal grant.

[0065] In addition, it carries out whether the ink which prevents by making the temperature up by heat energy use it positively as energy of the change of state from a solid condition to the liquid condition of ink, or is solidified in the state of neglect for the purpose of antiflashing of ink is used. Anyway, ink liquefies by grant according to the record signal of heat energy. The activity of the ink of the property which will not be liquefied without heat energy, such as what carries out the regurgitation as liquefied ink, and a thing which it already begins to solidify when reaching a record medium, is also applicable to this invention. In such a case, ink is good for a porosity sheet crevice or a breakthrough which is indicated by JP,54-56847,A or JP,60-71260,A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the condition of having been held as a solid. In this invention, the most effective thing performs the film-boiling method mentioned above to each ink mentioned above.

[0066] Furthermore, in addition, as a gestalt of the recording device concerning this invention, although prepared in one or another object as an image printing terminal of information management systems, such as a word processor and a computer, the gestalt of the reproducing unit combined with others, a

reader, etc. and the facsimile apparatus which has a transceiver function further may be taken.

[0067]

[Effect of the Invention] As mentioned above, as explained to the detail, the yield became possible [, obtaining the compact ink jet recording head for page width line printers at best moreover] by the low price by this invention.

[Translation done.]

*** NOTICES ***

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the explanatory view showing the description of the ink jet recording head of this invention.

[Drawing 2] It is the explanatory view showing the description of the ink jet recording head of this invention of other examples.

[Drawing 3] It is the typical perspective view showing the configuration of the ink jet recording head of this invention.

[Drawing 4] It is drawing explaining the configuration of the main parts of the ink jet recording head of this invention.

[Drawing 5] It is the detail drawing in the condition of having arranged the subunit (heater board) on the base plate.

[Drawing 6] With the detail drawing of an example of a top plate, A is a front view and B is a sectional view.

[Drawing 7] It is drawing showing the condition at the time of junction of a top plate and a subunit (heater board).

[Drawing 8] It is the mimetic diagram of the ink jet cartridge which applied the ink jet recording head of this invention.

[Drawing 9] They are a line type ink jet recording head and approximate account drawing of the ink jet recording device.

[Drawing 10] It is drawing showing the recording device which carried the small recording head.

[Drawing 11] It is drawing showing the important section of an example of the conventional long ink jet recording head.

[Description of Notations]

1 Energy Generation Component

2 Subunit (Silicon Substrate Unit)

3 Base Plate

4 Fluid Hard Spot Material Which Filled Clearance

5 Top Plate (Complex of 2nd Substrate and Delivery Formation Member)

6 Delivery (Orifice)

7 Guide Slot of Fluid Hard Spot Material

10 1st Substrate

11 Ink Jet Recording Head Unit
12 Energy Generation Component
13 Silicon Substrate
14 Top Plate Section
15 Addressing Side with Side Face of Ink Jet Recording Head Unit
16 Attach and it is Septum between Reliance Side and Passage of Edge of Ink Jet Recording Head Unit.
100 Heater Board (Subunit)
101 Regurgitation Energy Generation Component
102 Pad
200 Wiring Substrate
201 Connector
202 Signal and Electric Power Supply Pad
300 Base Plate
301 Adhesives
302 Encapsulant
400 Top Plate
411 Liquid Room
412 Passage
413 Orifice
414 Ink Feed Hopper
415 Supporter Material
500 Spring
510 Spring Holder
600 Ink Jet Recording Head
700 Record-Medium Conveyance Roller
800 Record Medium
900 Ink Jet Recording Head
901 Ink Tank
1001 Ink Tank Section
1002 Recording Head Section
1003 Motor
1004 Carriage Shaft

[Translation done.]